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ABSTRACT

The maintenance of learned behavior is a problem frequently faced by teachers of persons with severe disabilities. The study examined the use of a self-management procedure to improve and maintain the work performance of 6 young adults (ages 18-20) with severe retardation in integrated job settings. Students were taught to self-monitor their work rate on job tasks in a restaurant setting, evaluate daily performance against criterion, and recruit contingent feedback from supervisors. A multiple baseline design across subjects, and two within-series reversals, indicated a functional relationship between self-recruited feedback and maintenance of improved work rate. Self-monitoring of work rate alone was not a consistently effective maintenance strategy. Results are discussed in terms of the need for a comprehensive technology of maintenance that requires a low response cost to apply over long periods of time. A 52-item reference list is appended. (Author)

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Self-Recruited Feedback: A Cost-Effective Procedure for Maintaining Behavior

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Running Head: SELF-RECRUITED FEEDBACK

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Abstract

The maintenance of learned behavior is a problem faced frequently by teachers of persons with severe disabilities. The present study examines the use of a self-management procedure to improve and maintain work performance of young adults with severe disabilities in integrated job settings. Students were taught to self-monitor work rate on job tasks, evaluate daily performance against a criterion and recruit contingent feedback from supervisors. A multiple baseline design across subjects, and two within series reversals, indicate a functional relationship between self-recruited feedback and maintenance of improved work rate. Self-monitoring of work rate alone was not a consistently effective maintenance strategy. Results are discussed in terms of the need for a comprehensive technology of maintenance that requires a low response cost to apply over long periods of time.

Self-Recruited Feedback: A Cost-Effective Procedure for Maintaining Behavior

Maintaining behavioral gains lies at the heart of meaningful lifestyle change for people with severe disabilities. Maintenance is particularly critical when adolescents and adults with severe disabilities are first employed. Successful employment results when an individual performs valued labor over extended periods of time with minimal supervision. To achieve this goal, behavioral procedures are needed to build and maintain adaptive work skills. At present, the technology for skill acquisition far exceeds the companion technology for maintaining acquired skills. One strategy that may contribute to a technology of maintenance is self-recruitment of feedback from the external environment.

Maintenance refers to the durability of a stimulus control relationship over time (Terrace, 1966). A behavior has maintained if it continues to be performed when conditioned stimuli are presented. While a comprehensive technology of maintenance has proven elusive, an array of maintenance strategies has emerged. Foremost among these have been (a) training to a high criterion (i.e., high fluency)(Haring, Liberty, & White, 1980), (b) delivering intermittent reinforcement in the training and performance settings (Ferster & Skinner, 1957; Koegel & Rincover, 1977), (c) making the contingencies between training and performance settings indistinguishable (Rusch, Connis, & Sowers, 1978; Stokes & Baer, 1977), (d) training with discriminative stimuli that are available in the performance setting (Koegel & Rincover, 1974; Rincover & Koegel, 1975; Stokes & Baer, 1977), (e) teaching skills that produce naturally available reinforcers

(Baer & Wolf, 1970; Stokes & Baer, 1977), and (f) ensuring adequate opportunity to perform the skill after training (Greenwood, Delquadri, & Hall, 1984; Hall, Delquadri, Greenwood, & Thurston, 1982; Horner, Williams, & Knobbe, 1985).

Recently, self-management techniques have been proposed as effective strategies for maintaining behavior (Fowler, 1984; Gifford, Rusch, Martin, & White, 1984; Liberty & Michael, 1985; O'Leary & Dubey, 1979; Rosenbaum & Drabman, 1979; Rusch & Schutz, 1981; Wacker & Berg, 1986). Self-management refers to the modification or maintenance of an individual's behavior as a function of the same individual manipulating antecedent and/or consequent events associated with a target behavior (Brigham, 1982; Mahoney & Thoresen, 1974). Manipulation of antecedent events via self-instruction and self-delivered prompts has been used to maintain the work-behavior of people with disabilities (Wacker & Berg, 1986). Rusch, Morgan, Martin, Riva and Agran (1985) used a self-instruction package developed by Bornstein and Quevillon (1976) in which the individual repeats a set of instructions when the target situation(s) arises. This approach was effective in maintaining the vocational skills of two moderately retarded women. Literature also exists on the effective use of self-delivered picture cards and other visual prompts for maintaining time-management and work completion skills (Connis, 1979; Shafer & Brooke, 1984; Sowers, Rusch, Connis, & Cummings, 1980; Sowers, Verdi, Bourbeau, & Sheehan, 1985; Wacker & Berg, 1983; Wacker, Berg, Berrie, & Swatta, 1985).

Self-delivered consequences in the form of self-monitoring (Coleman & Whitman, 1984; Horner & Brigham, 1979; Rudrud, Rice, Robertson, & Tolson,

1984), and self-delivered reinforcers (cf. Baer, Fowler, & Carden-Smith, 1984; Coleman & Whitman, 1984; Liberty & Michael, 1985) have also proven effective for managing the behavior of people with disabilities. Self-delivery of money, tokens or food has resulted in improved or maintained vocational performance with workers who were diagnosed as mildly to profoundly retarded (Bates, Renzaglia, & Clees, 1980; Gardner, Clees, Berry, & Nowinski, 1983; Hanel & Martin, 1980; Helland, Paluck, & Klein, 1976; Horner, Lahren, Schwartz, O'Neill, & Hunter, 1979; Jackson & Martin, 1984; Srikameswaran & Martin, 1984; Zohn & Bornstein, 1980).

While interest in the use of self-management procedures to maintain work skills is high, there are too few strategies for applying this technology in real-world situations. Three criteria appear critical if self-management systems are to receive wide use in work settings. First, research must demonstrate that specific self-management packages are functionally related to maintained work performance. To date many studies have documented the maintenance of work rate or work accuracy during a self-managed intervention, but they have not provided experimental documentation of a relationship between the self-management intervention and maintained responding (Liberty & Michael, 1985; Rusch & Kazdin, 1981; Wacker & Berg, 1986). Second, an effective self-management strategy should show that the time and effort needed to acquire the self-management skills is not prohibitive. Finally, self-management systems should be effective for long periods of time with minimal or no additional supervisor support.

Gross and Wojnilower (1984) suggest that no procedure using self-delivered reinforcers will maintain over long time periods without

some external monitoring. This practical, though disconcerting, assumption suggests that self-management systems designed to maintain behavior for months (or years) may need to combine the use of self-management and external management systems. Seymour and Stokes (1976) provide one example of such a combination. They taught young women in a state maximum security unit to both self-monitor work behavior and to "recruit" supervisor attention to their improved work behavior. This package resulted in increased work performance. Seymour and Stokes did not, however, address maintenance of the improved work skills.

The present study extends recent work on both maintenance and self-management. The primary research question under analysis was whether a functional relationship exists between maintenance of work rate, and use of self-recruited feedback. Self-recruited feedback includes three components: (a) self-monitoring of a target behavior; (b) self-evaluation of performance against a pre-defined criterion; and (c) recruitment of contingent feedback from the external environment. Secondary questions addressed the time needed to learn the self-management skills, the accuracy of self-monitoring and self-delivery of data to supervisors, and the time required by supervisors to participate in the intervention.

Method

Subjects and Settings

Five men and one woman, ages 18-20 years old with IQs ranging form 36 to 54 ($\bar{x}$ = 44) on standard intelligence tests participated in the study (see Table 1). Each of the participants lived at home with their families and were enrolled in a classroom for students with severe handicaps in the

local school system. Participants were selected based on three criteria: (a) placement in an integrated job setting as a part of each student's planned individual education program (IEP); (b) improved vocational ability as a goal on the student's IEP; (c) the expectation of school personnel that each student would continue in his or her job assignments for the duration of the study. All students had received some vocational training and vocational experience prior to the study. However, none of the participants performed job tasks independently. Participant's skills in matching and recording numbers were pre-assessed with two tests. The first test involved presenting the participants with a vertical list of 20 numbers, randomly selected from 1-99, and requesting that those numbers be written on an adjacent sheet of paper. The second task involved 10 trials in which each participant was asked to look at a digital stopwatch and point to the corresponding number on a sheet of paper that listed all minute values from 1 to 60. Four of the six participants demonstrated the ability to match and record one- and two-digit numbers (80% or better on both tests). Two subjects did not demonstrate the ability to match and record numbers (10% or less on both tests).

Insert Table 1 about here

The training and performance settings consisted of three restaurants. Five participants performed jobs in two restaurants housed in the student union building on a university campus. One participant (UR) performed job tasks in a small commercial restaurant in the local community.

Job Tasks

Six tasks were identified as regular duties performed by the students in their jobs. A task analysis and time standard was developed for each task using established training and Department of Labor guidelines (cf. Bellamy, Horner, & Inman, 1979). After the tasks were analyzed by trainers, a 'unit of work' was established for each task. Persons without identified disabilities engaged in these tasks on at least three separate occasions. These work rates were averaged to compute relevant time standards for each task. These time standards were validated by the supervisors in the restaurants. The six tasks and their respective time standards are provided in Table 2.

Insert Table 2 about here

Measurement

The primary dependent variables in this study were: (a) work rate (productivity) as measured by the percent of norm standard, (b) quality of work performed (percent of units completed correctly), and (c) the accuracy of self-management responses. Secondary variables of concern included the training time needed for acquisition of job tasks and self-management skills, and the frequency and duration of contacts by supervisors in the job settings.

Work rate/productivity. Independent observers unobtrusively recorded the start time and stop time for each work period, and used a count of permanent products to assess the number of units of work completed during the session. These data were then converted to work rate by

dividing the total number of units of work completed by the number of minutes spent working on the task for a work period. Work rate was converted to "norm standard" by dividing the observed work rate of participants by the standard work rate of the persons without disabilities who performed the task following Department of Labor standardization procedures.

Work quality. Commercial standards for work quality were established by the restaurant supervisors for each task. These standards were used by the data collectors to evaluate the quality of each work unit completed during each session. At the end of a work period, data collectors recorded the total number of work units and the number of those units that were completed to the quality standards. The percentage of work quality was obtained by dividing the number of units done correctly within a work period by the total number of units of work completed.

Accuracy of self-management responses. Participants received training on recording the number of units of work completed and the amount of time spent working on each task each day. The accuracy of each participant's self-recording was assessed after the participant left the work site by comparing the number of completed work units recorded by observers with the number of completed work units recorded by the participant in his/her notebook. These data yielded a percentage of participant accuracy by dividing the participant-recorded totals by the observer totals.

Job task and self-management response acquisition. Two measures were used to assess acquisition of job tasks and self-management responses:

minutes of instruction and the number of training trials to criterion. These measures were collected by trainers who (a) recorded the start time and stop time of each training session and (b) recorded the number of trials per session, where a "trial" involved the presentation and completion of one work unit.

Supervisor contacts. Each work site contained supervisors not affiliated with the study who were responsible for the flow of work within the setting. The frequency and duration of contacts these supervisors made with participants was monitored by observers for all tasks during all phases after the tasks were learned.

Observer Agreement

Observer agreement data were collected on at least 10% of all data points for each subject in each phase, except for the minutes of instruction and trials to criterion measures. Agreements for productivity data were calculated for minutes worked (with agreement being scored if observers were within one minute of each other) and the number of units completed. For work quality unit agreement was based on a unit-by-unit comparison. The accuracy of self-management responses, and supervisor contacts agreements were scored on a response-by-response basis. Percentage of observer agreement in all cases was calculated by dividing the number of agreements by the total number of observations. In addition to percent agreement, Cohen's Kappa (Hollenbeck, 1978) was also calculated for each variable.

Observer agreement (for work rate and work quality) ranged from 83% to 100% with an average observer agreement of 97.6% with Kappa computed at

.7986. Observer agreement on the accuracy of subject self-monitoring was 100%. Observer agreement for supervisor contacts averaged 97.19% with a range of 50% to 100%. Kappa on the number of contacts was .8985. Observer agreement on duration of supervisor contacts was 93.05% with a range of 50% to 100%. Kappa was .9025 for the duration of supervisor contacts.

Procedures

The focus of the study was on the analysis of a maintenance strategy for situations when current antecedent and consequences of events prove insufficient to maintain performance gains. The design called for each of six participants to learn and perform two tasks. Three participants were randomly selected to receive training on a self-monitoring strategy as part of their initial task training; three participants were trained on their tasks without the self-monitoring component. Due to demands of one restaurant, UR was restricted to one task during the study; thereby limiting the total number of tasks to eleven.

After the six participants acquired the tasks and performed them in production settings, an assessment was made of those tasks that were being maintained at or near the work rate achieved when training was terminated. Three participants (AM, AK, HS) met this maintenance criterion on their tasks. The remaining three participants demonstrated notable decreases in their productivity. A multiple baseline design across these three participants and their five tasks was used to assess the effects of self-recruited feedback on the maintenance of the work rates established during training. To provide added experimental control, reversals were conducted with two series after self-recruited feedback had been

introduced. The five phases within the study were: Training with Self-Monitoring, Training Only; Self-Monitoring Production; Production Only; and Self-Recruited Feedback.

Training with Self-Monitoring. During this phase, participants received one-to-one training on the specific steps required by their work tasks and the behaviors needed to self-monitor both time spent working and the number of work-units completed. Training sessions were conducted 5 days a week and lasted approximately 30 minutes per day on each task. Training procedures closely followed the recommendations of Bellamy et al. (1979). Learners were provided with modeling, verbal prompts, and physical prompts to elicit accurate responses. Correct responses were praised. When errors occurred the trainer stopped the trial, returned the training setting to the situation that led to the error, provided additional assistance to achieve correct responding, and praised the correct response. Across trials, the level of assistance and rate of praise were faded to approximate the support the learner would experience in the natural work setting.

In conjunction with daily training on the work task, participants also received training on self-monitoring. Each participant was given a file box (23 cm x 13.5 cm x 11 cm) which contained a stopwatch (Innovative Time Corporation, Model L331B), a small spiral bound notebook (12.5 cm x 8 cm), and a counting device (SportsCraft Counter). Participants were trained to begin each session by taking their stopwatch out of the file box, resetting it to 0, and starting it. When the work or training session was over the participant returned to the file box, stopped the stopwatch, and recorded

the number of minutes worked and the number of units completed in the notebook. Two participants (AM and UR) performed tasks with fixed time periods each day. Rather than use stopwatches for these tasks AM and UR monitored their time-on-task with a Sunbeam Electronic Kitchen Timer that was set each day.

Units of work completed were self-monitored by teaching each participant what a "unit of work" involved (see Table 2), and then teaching use of the counter as a mechanism for monitoring the frequency of units completed. In some cases the counters were mounted on the work station (i.e., for pots and pans), for other tasks the participants carried the counters in a pocket of their work apron (i.e., restocking). At the end of a work period a participant recorded the number of units completed in his/her notebook beside the number of minutes worked and reset the counter to 0. Praise from the supervisor was delivered for using the stopwatch and counter, but no feedback was given related to the number or quality of units produced during a work period. Training was terminated when a participant demonstrated both 90% accuracy on performing the task and 90% accuracy on self-monitoring work rate for 2 consecutive days.

Task Training Only. During the Task Training Only phase participants received exactly the same training on tasks, with the same materials, consequences, and training criterion as in the Training with Self-Monitoring phase. The only difference was that instruction in this phase did not include training on the self-monitoring skills.

Production Only. The Production Only phase assessed performance of the tasks under normal production conditions for participants who had Task

Training Only without self-monitoring. No self-monitoring occurred, no training prompts were delivered, and feedback was received from supervisors in the rate and manner typically available in the work setting. Trainers were still present in the production environment, but only as data collectors.

Self-Monitored Production. Participants who had received self-monitoring during training continued to self-monitor when they entered production and the trainer faded to a role as an unobtrusive data collector who provided no feedback. However, if a participant self-monitored with less than 80% accuracy for 2 consecutive days, a 30 minute "booster" session was provided the next day.

The restaurant supervisors delivered their usual feedback to the participants during this phase. As with the Production Only phase, supervisors were aware that the participants were part of a research study on self-management; however, they had no knowledge of the phases of the study or the expected effects within each phase.

Self-Recruited Feedback. The Self-Recruited Feedback phase was conducted in the same production settings as the previous production phases, but with two additions: (a) a criterion of acceptable performance for each task was defined for each participant and (b) a strategy was trained that allowed participants to use their self-monitoring data to recruit feedback from their trainers/supervisors. The supervisors in each restaurant setting were asked to define an acceptable work rate for each participant on each task. When establishing these criteria the supervisors

had information about the norm standard for each task and each participant's work rate during the previous phase.

Participants used the "criterion for acceptable performance" in two ways to determine if they were doing "well." The first strategy was used by AG and LG who worked on tasks for variable lengths of time. For each task performed, a matrix was drawn that listed minutes worked across the horizontal axis and the number of units completed (beginning at the top) down the vertical axis. The cells in the matrix were colored to indicate the area in which work rate was acceptable. At the end of a work period the participant positioned an L-shaped ruler (C-Thru Ruler, Model L-808) over the two axes to match up the minutes worked and units completed with the appropriate numbers on the matrix axes. If the inside corner of the ruler was in the colored area of the matrix the participant had met, or exceeded, the criterion work rate and s/he placed a "+" on the bottom of the notebook page for that day. If the inside corner of the ruler did not reach a colored cell on the matrix the participant recorded a "-" on the bottom of the notebook page.

The final step in this strategy was for the participant to end each work period by taking his/her notebook to the supervisor (or trainer) and recruit feedback. If the notebook contained a "+" the participant received praise (e.g., "You did a good job today. That was fast working."). If the notebook contained a "-" the participant received disapproval and encouragement to do better tomorrow (e.g., "You worked too slowly today. I hope you do better tomorrow and get a plus."). The time taken to deliver this feedback was approximately 20-60 seconds.

Participants who worked on fixed time periods used a modified strategy to evaluate their work rate. Participant UR did not reliably match and record numbers from his timer or counter. As a result, his self-monitoring strategy was modified by coloring in the numbers on his counter so that colored numbers corresponded with the predefined criterion for "acceptable" rate defined by the supervisors. If UR completed enough work units to make the colored numbers come up on his counter he entered a "+" in his notebook at the end of the work period. If he did not complete enough work units to reach the colored numbers he entered a "-". Once the notebook was marked, UR recruited feedback from his trainer/supervisor in the same manner described above.

Throughout the Self-Recruited Feedback phase participants self-monitored, and received feedback only on the basis of work rate. For participants engaged in the task of Pots and Pans, there was a reduction in work quality and two "booster" training sessions were added. These booster sessions followed the same training procedures described above except participants were prompted to check the pots and pans in between washing and rinsing as well as checking at the end of the entire response chain.

Production Only$_2$. This phase exactly replicated the initial Production Only phase.

Self-Recruited Feedback$_2$. This phase exactly replicated the initial Self-Recruited Feedback phase.

Results

The initial training and production phases (Production Only and Self-Monitored Production) included assessment of results from all six

participants across 11 tasks. The focus of this assessment was on the effort required to achieve the training criterion and the durability of responding in production. The second level of analysis focused on the three participants and five tasks in which maintenance of work rate did not occur. The maintenance analysis addressed the effects of the Self-Recruited Feedback procedure to improve and maintain work rate.

Training

All six participants reached the training criterion. The number of trials and time (hours) to criterion are provided in Table 3. Considerable variability in training trials and time was noted both across participants learning the same task and within participants learning different tasks. There was no evidence, however, that the added instruction on self-monitoring skills affected the time or trials required to reach the training criterion.

Insert Table 3 about here

Production

Each participant entered production (with or without self-monitoring) when s/he met the training criterion for a task. Table 4 provides a summary of the work rates of each participant during the last four days of training, and during the following production phase. Three of the participants (AM, AK, and HS) demonstrated maintenance or improvement in their work rate after entering production on both of their tasks. Of thee three, AK and HS had been trained to self-monitor during task training.

Three participants (AG, LG, and UR) displayed significant reductions in their work rates for the five tasks they had acquired during training. Of these three, AG had been trained to self-monitor during training. All three participants who were trained to wash dishes demonstrated poor maintenance. No other patterns across tasks were apparent.

Insert Table 4 about here

Self-Recruited Feedback

Self-Recruited Feedback was introduced in a multiple-baseline format with all five tasks (three participants) where maintenance was inadequate. The results across all phases for these five tasks are presented in Figure 1. With each task there was improvement in level and/or trend following the initiation of Self-Recruited Feedback. Participant LG, for example, performed the Dishes task with increasing slow work rate across the 27 days in his first production phase (mean norm standard = 50.5%, slope = -.0123). Following implementation of the Self-Recruited Feedback procedures LG performed dishwashing with an increasing work rate, ending the phase with a near 100% work rate and an across phase trend of +.0467. Each of the remaining four series demonstrate an increase in level of work rate (range, 18.8% to 23%) following introduction of the Self-Recruited Feedback_1 (see Table 5). In two cases, however, (LG-Pots and Pans; AG-Pots and Pans) the overall production gains noted during Self-Recruited Feedback_1 were accompanied by high variability.

Insert Figure 1 and Table 5 about here

To assess if the Self-Recruited Feedback procedures were related to maintaining the improved work rates, reversals were performed in two series (LG-Dishes and UR-Dishes). During the reversal, Production Only procedures were reinstated, and Self-Recruited Feedback procedures were suspended. For both participants, the reversal to Production Only corresponded with a change in trend toward lower productivity levels. When Self-Recruited Feedback procedures were reinstated improved rates of production occurred for both participants. For LG-Dishes the reversal effect in Self-Recruited Feedback_2 was evidenced by an immediate increased production rate over the first 6 days of the phase to near 100% of norm standard. The remaining days of the phase displayed higher variability. UR-Dishes provided a less substantial reversal across Self-Recruited Feedback_1, Products_2 and Self-Recruited Feedback_2. It is important to note, however, that 5 of the last 7 days in the Production_2 condition for UR were below the established production criterion level. These were the first days of sub-criterion performance for UR since he entered the Self-Recruited Feedback_1 condition. The decision to end Production_2 for UR was made in response to employer comments that UR's performance was deteriorating. Similar employer comments were not received for any of the other participants.

In addition to monitoring work rate, data were collected on the percentage of work units that did not meet quality criteria (i.e.,

production errors). Table 6 provides a summary of error percentages for the five series reported in Figure 1. Errors were much more likely to occur with the Pots and Pans task where a high accuracy criterion of cleanliness was established. Across three series (AG-Dishes; LG-Pots and Pans; and AG-Pots and Pans) there were substantial increases in error rates when the Self-Recruited Feedback procedures were implemented. Slight decreases in errors were noted for LG-Dishes and UR-Dishes when Self-Recruited Feedback was used. Error levels decreased 14% and 22% respectively for LG-Pots and Pans and AG-Pots and Pans after booster training, but still remained at high levels.

Insert Table 6 about here

Self-Management Accuracy

Two self-management skills were taught within the study. The first was to self-monitor time worked and units produced. The second was to use these data to self-evaluate if work rate during a period met the target criterion. Table 7 presents the average percent agreement between participants and observers for "units completed" and "time worked." In general, participants were very competent at recording units completed (85%-98%) and more variable in their accuracy of recording time worked (62%-95%). Participant AG received one booster session on self-monitoring for Dishes and two booster sessions for Pots and Pans. Neither of these sessions coincided with phase changes.

Insert Table 7 about here

The three participants who entered Self-Recruited Feedback were very accurate in their assessment of whether the production criterion was met. The average percentage agreement between observers and participants for correct evaluation during Self-Recruited Feedback phases was 95% (range 84%-100%).

Supervisor Contacts

One variable that could have accounted for improved production rates during the Self-Recruited Feedback phase was the frequency and duration of contacts that participants received from supervisors. No pattern of shift in frequency or duration of supervisor contacts was noted across phases. The average frequency of supervisor contacts per day, and the average duration of these contacts, are provided in Table 8. Those participants working in the university restaurant received contacts less than once per task per day ($\bar{x}$ = .67). The one participant working in the downtown restaurant (UR) averaged 4.3 contacts per day. This rate of contacts, however, was stable across phases.

Insert Table 8 about here

Discussion

The present report addresses the need in applied behavior analysis for a technology of maintenance. Self-management interventions within an

effective maintenance technology will involve strategies that (a) are easily learned by individuals with disabilities, (b) require a low supervisor response cost to apply over long time periods, and (c) have documented effectiveness at maintaining adaptive behavior. One intervention package which meets these criteria is self-recruited feedback.

Results from the present analysis document a functional relationship between the use of Self-Recruited Feedback and maintenance of work rate in job settings. The multiple baseline introduction of Self-Recruited Feedback, and the two reversals after Self-Recruited Feedback was in place (LG-Pots and Pans; UR-Dishes), provide experimental control documenting the effect of the intervention to maintain work rates that met or exceeded supervisor's standards for up to 2 months in job experience situations. The magnitude of this demonstration is limited in part by the high variability of LG and AG productivity rates during Self-Recruited Feedback, and the decreasing trends toward the end of the study by LG on both tasks. The findings are consistent, however, with Seymour and Stokes (1976) demonstration that self-recruitment of feedback can improve performance.

The secondary analyses provide descriptive information suggesting: (a) acquisition of the self-monitoring, self-evaluation and self-recruitment skills required by the intervention did not add extensive training time for learners with moderate and severe retardation; (b) the self-recruited feedback package was effective across multiple tasks; and (c) the package required minimal supervisor time or skill to implement once training was complete.

The initial Training and Production phases of the study offer two additional implications for the use of self-management procedures to

promote maintenance. The first implication arises from the fact that only three of the six participants demonstrated poor maintenance after reaching the training criterion. Neither level of disability, training on self-monitoring, prior experience in work settings, nor performance on the pre-test for number matching covaried with poor maintenance during $Production_1$. Anecdotal reports from observers indicated that in two cases (HS and AK) participants demonstrating good maintenance emitted regular, positive verbalizations about their jobs and coworkers. It is possible that the natural consequences associated with performing the jobs, and participating in the social context of the jobs, may have been differentially reinforcing across the six participants. At a minimum, these results suggest that maintenance procedures, such as self-recruited feedback, may be needed with only some workers, in some situations. This would imply that more effort is needed to define assessment procedures that predict when maintenance support is appropriate.

A second implication from $Production_1$ results lies in the absence of a clear self-monitoring effect. Only two of the three participants trained to self-monitor demonstrated maintenance of acceptable production rates during the first production with self-monitoring phase. AG's poor maintenance under self-monitored production suggests that self-monitoring alone was not sufficient to maintain production rates, and was not the major component of the self-recruited feedback package that contributed to maintained work rate. Self-monitoring may be a necessary but insufficient part of the self-recruited feedback package. This logic is consistent with research documenting the inconsistent, or short-lived, effects of

self-monitoring (Horner & Brigham, 1979; Srikmeswaran & Martin, 1984; Zohn & Bornstein, 1980). Given that other researchers report self-monitoring alone to be an effective maintenance strategy (Coleman & Whitman, 1984; Liberty, 1984; Shafer & Brooke, 1984; Rudrud et al., 1984), further research is needed to define the situations in which no support, self-monitoring alone, or more than self-monitoring is needed to maintain adaptive behavior.

An important limitation of the present results is the low percent of normal production rates that the participants maintained even with self-recruited feedback. None of the participants averaged >90% productivity; and AG-Pots and Pans worked at only 45% of norm standard while self-recruiting feedback. It is important to note, however, that while full productivity is desirable, it is not a requirement for obtaining or maintaining employment (Mank, Rhodes, & Bellamy, 1986). The current "supported employment" initiative (Will, 1984) has led to many demonstrations of work opportunities for persons with disabilities where work quality and dependability are emphasized and full productivity is not a requirement for access to integrated employment (Mank et al., 1986). This is possible because individual productivity can be measured and wages determined based on a worker's percent productivity (Bellamy, Rhodes, & Albin, 1986).

The need for a comprehensive technology of maintenance, and the positive potential that self-recruited feedback has for this technology, suggests several avenues for further research. As with any intervention package, the need exists to separate the effects of individual components. For example, the effects of "criterion setting" and self-evaluation cannot be separated from the effects of "self-recruited feedback" in the present

design. It is also possible that "criterion setting" had an effect on the content and accuracy of supervisor contact. Anecdotal reports from observers indicated that supervisor feedback during initial production phases was often general and not differentially related to the performance of a participant during a specific day. LG received praise for "doing good work," for example, on two days when he performed at his lowest production rate on Pots and Pans. It is possible that the contingent content of supervisor contacts during the Self-Recruited Feedback phase was itself a major change from previous phases.

The use of self-management procedures can result in increased independence and decreased dependence on supervisor contact and intervention (e.g., Helland et al., 1976; Horner et al., 1979; Shafer & Brooke, 1984; Wehman et al., 1978). Most self-management studies to date, however, have maintained some aspect of externally delivered rewards. Gross and Wojnilower (1984) question if any self-reinforcement intervention can maintain over time without some external monitoring. Self-recruited feedback is one approach for maintaining external control at a minimal effort to supervisors. Further analysis is needed with intervention packages that assess the role of external consequences in self-management strategies designed to promote maintenance.

Another important direction for future research is analysis of longer maintenance phases. The present study was terminated due to the participants leaving their work sites at the end of a school year. Future research needs to document procedures that maintain behavior for 10-12 months or more. The process in conducting such analyses may well involve

initial pilot studies that assess maintenance over a 1- to 2-month time period with results form the pilot study used to modify procedures prior to conducting longer studies. In all cases, maintenance analyses should include information about the flexibility of the intervention (can it be used across many different behaviors), the cost of training, and the effort required to train the maintenance skills and the staff time needed for continued use of the intervention.

A fourth research area suggested by the present results arises from the need we encountered to add booster training on work quality with participants who performed the task of Pots and Pans. In both cases the issue was less one of poor productivity than one of deteriorating quality. It is possible that learners in some conditions will need to self-monitor more than one dimension, or feature, of their behavior for self-recruited feedback to be effective. Future research is needed to examine the effect of monitoring multiple behaviors as part of a self-recruited feedback package.

A final area for future research is development of assessment procedures that allow prediction of situations where maintenance is likely to be an issue. Some tasks may be more likely to result in poor maintenance (e.g., the quality on Pots and Pans). Individuals who display poor maintenance on some tasks may be more likely to need maintenance support on other tasks. As effective maintenance strategies are identified, the prediction of maintenance problems related to both work rate and work quality will become increasingly important.

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Footnotes

[1]Copies of the task analyses and time studies may be obtained from the first author.

Table 1

Participant Description

Participant	Age	Sex	IQ	Instrument
AG	18	M	40	WISC-R
HS	19	M	36	Stanford-Binet
AK	19	F	40	WISC-R
AM	20	M	43	Stanford-Binet
LG	18	M	54	WAIS-R
UR	20	M	50	WAIS-R

Table 2

Time Standards and Work Unit Definitions for Each Task

Tasks	Units of Work	Time Standard
Pots and Pans	1 unit = 1 pot or pan	0.99/minute
Dishes	1 unit = 1 load of dishes	0.55/minute
Restock Dishes	1 unit = 1 trip	0.16/minute
Take Down Dirty Dishes	1 unit = 1 trip	0.20/minute
Bussing	1 unit = 1 tray of dishes	2.12/minute
Dishes (UR)	1 unit = 1 load of dishes	0.25/minute

Table 3

Trials and Time to Criterion During Training

Participant	Task	Training Condition	Trials	Time (in hours)
AG	Pots and Pans	with self-monitoring	299	17.63
	Dishes	with self-monitoring	876	40.38
HS	Pots and Pans	with self-monitoring	503	37.30
	Restock	with self-monitoring	92	17.57
AK	Pots and Pans	with self-monitoring	128	11.33
	Take Down	with self-monitoring	125	20.75
AM	Bussing	without self-monitoring	453	7.97
	Restock	without self-monitoring	17	5.75
LG	Pots and Pans	without self-monitoring	596	25.77
	Dishes	without self-monitoring	129	9.58
UR	Dishes	without self-monitoring	260	26.50

Table 4

Mean Percent of Norm Standard During the Last Four Days of Training and During Initial Production Phases

Participant	Task	Percent of Norm Standard During Last Four Days of Training	Percent of Norm Standard During First Production Phase
AG	Pots and Pans	34.8%	22.9%
	Dishes	84.3%	62.8%
HS	Restock	67.2%	64.7%
	Pots and Pans	23.5%	45.0%
AK	Take Down	58.3%	64.6%
	Pots and Pans	23.9%	46.9%
AM	Bussing	41.9%	50.6%
	Restock	42.8%	50.9%
LG	Dishes	58.0%	50.5%
	Pots and Pans	52.5%	48.1%
UR	Dishes	73.0%	52.7%

Table 5

Work Rate During the Initial Production Phase and Initial Self-Recruited Feedback Phase

Participant	Work Rate in First Production Phase	Work Rate in First Self-Recruited Feedback Phase	Percentage Points Changed
LG Dishes	50.5%	50.7%	0.2
AG Dishes	62.8%	81.6%	18.8
LG Pots & Pans	48.1%	71.1%	23.0
UR Dishes	52.7%	72.0%	19.3
AG Pots & Pans	22.9%	45.3%	22.4

Table 6

Percentage of Work Unit Errors by Phase, Task, and Participant

Participant	Task	Phase	Percentage Errors
LG	Dishes	$Production_1$	3.8%
		$S\text{-}R\ Feedback_1$	2.0%
		$Production_2$	7.4%
		$S\text{-}R\ Feedback_2$	5.3%
AG	Dishes	S-Monitored Production	9.7%
		S-R Feedback	22.7%
LG	Pots and Pans	Production	18.9%
		S-R Feedback	46.3%
		S-R Feedback after Retraining	32.7%
UR	Dishes	$Production_1$	9.9%
		$S\text{-}R\ Feedback_1$	7.6%
		$Production_2$	6.8%
		$S\text{-}R\ Feedback_2$	3.5%
AG	Pots and Pans	S-Monitored Production	39.0%
		S-R Feedback	56.0%
		S-R Feedback after Retraining	34.4%

Table 7

Self-Monitoring Accuracy

Participant	Task	Phase	Observer-Participant Agreement on Units Completed	Observer-Participant Agreement on Amount of Time Worked
LG	Dishes	S-R Feedback$_1$	95%	95%
		S-R Feedback$_2$	98%	94%
AG	Dishes	S-Monitored Production	88%	64%
		S-R Feedback$_1$	98%	62%
LG	Pots & Pans	S-R Feedback$_1$	95%	96%
		S-R Feedback after Retraining$_1$	97%	100%
UR	Dishes	S-R Feedback$_1$	85%	63%
		S-R Feedback$_2$	98%	86%
AG	Pots & Pans	S-Monitored Production	90%	78%
		S-R Feedback$_1$	90%	73%
		S-R Feedback after Retraining$_1$	92%	95%

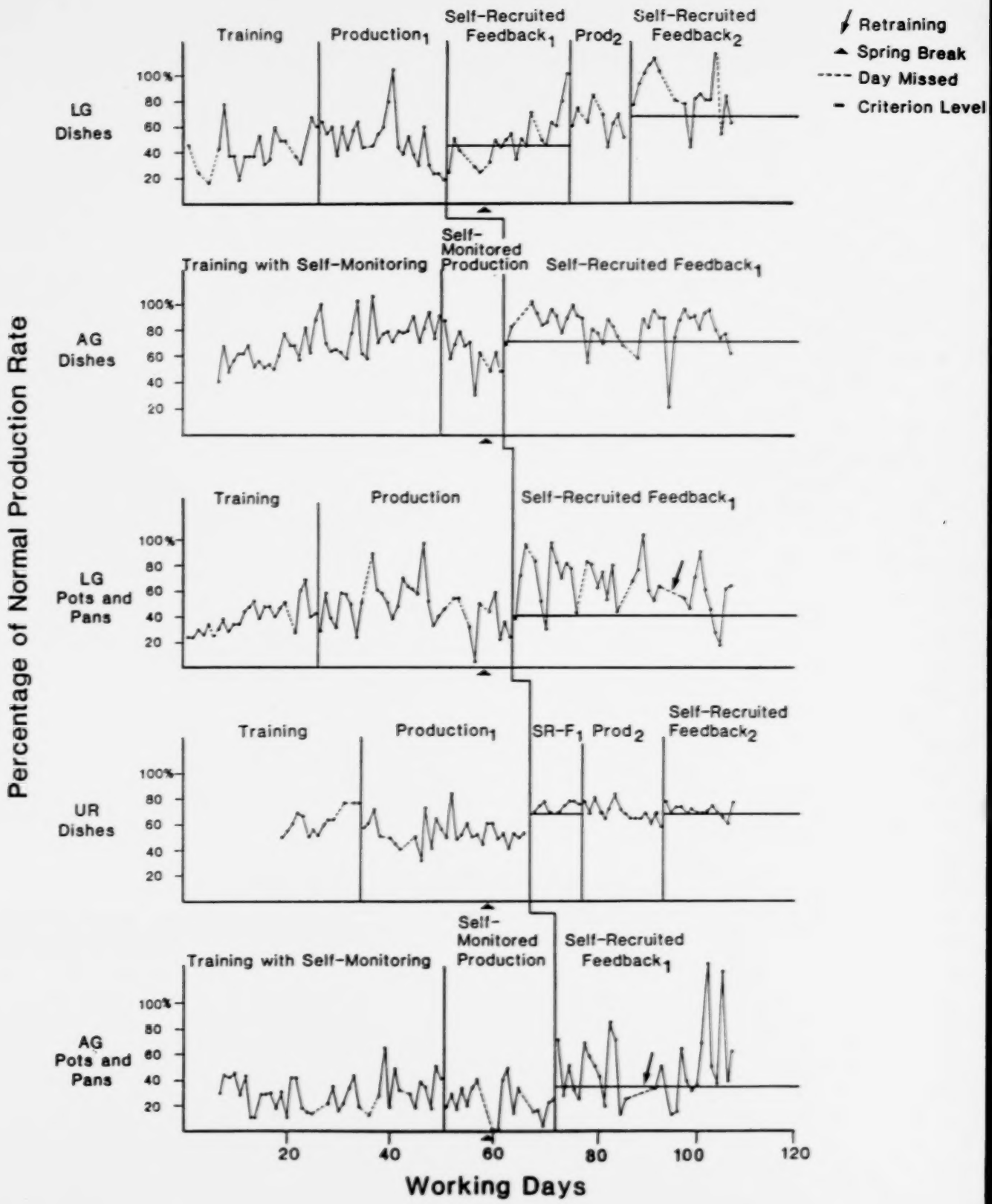
Table 8

Frequency and Duration of Supervisor Contacts

Participant	Task	Phase	Average Contacts Per Day	Average Minutes Per Contact
LG	Dishes	$Production_1$	0.42	3.40
		$S\text{-}R\ Feedback_1$	0.35	1.09
		$Production_2$	0.20	0.75
		$S\text{-}R\ Feedback_2$	0.75	1.67
AG	Dishes	S-Monitored Production	1.18	2.00
		S-R Feedback	0.86	1.38
LG	Pots & Pans	Production	0.37	1.15
		S-R Feedback	0.52	0.54
		S-R Feedback after Retraining	0.67	0.67
UR	Dishes	$Production_1$	3.34	0.50
		$S\text{-}R\ Feedback_1$	4.00	0.50
		$Production_2$	6.00	0.50
		$S\text{-}R\ Feedback_2$	3.86	0.50
AG	Pots & Pans	S-Monitored Production	0.83	1.43
		S-R Feedback	0.31	0.38
		S-R Feedback after Retraining	0.88	0.61

Figure Captions

Figure 1. The percentage of norm standard across phases for those participants and tasks where maintenace was inadequate.


Retraining
Spring Break
Day Missed
Criterion Level
Training
Production1
Self-Recruited Feedback1
Prod2
Self-Recruited Feedback2
LG Dishes
Training with Self-Monitoring
Self-Monitored Production
Self-Recruited Feedback1
AG Dishes
Training
Production
Self-Recruited Feedback1
LG Pots and Pans
Training
Production1
SR-F1
Prod2
Self-Recruited Feedback2
UR Dishes
Training with Self-Monitoring
Self-Monitored Production
Self-Recruited Feedback1
AG Pots and Pans
100%
80
60
40
20
20
40
60
80
100
120
Working Days
Percentage of Normal Production Rate